

Idaho Incubation Fund Program

Final Report Form

Proposal No. IF13-007
Name: Trevor Lujan
Name of Institution: Boise State University
Project Title: A Computational Method to Advance the Clinical Care of Bone Fractures

Information to be reported in your final report is as follows:

1. *Provide a summary of overall project accomplishments to include goals/milestones met, any barriers encountered, and how the barriers were overcome:* The major milestones for the project have been **successfully completed**. Milestone 1 was to automate callus measurement using OrthoRead software. This required the identification and implementation of algorithms that would reduce user input (mouse clicks) and be insensitive to image rotation and image resolution. Barriers to accomplishing these tasks were the absence of these specific features in currently available software, and the need to perform these functions quickly. To overcome these barriers, we performed an extensive literature survey to identify feasible image processing algorithms, and two 'dynamic' edge detection methods were adopted from the literature and implemented into the code. These algorithms were unaffected by rotation and resolution, and improved program speed up to 10x. Milestone 2 was to develop a graphic user interface. Barriers to accomplishing this task were grant time constraints and making an intuitive user experience. A literature search led to the discovery of ImageJ software, an open source code that permitted us to efficiently build the Java foundation for orthoRead. By using iterative third-party testing and prioritizing simplicity, an intuitive user interface was built (Fig. 1).



Fig. 1: Beta version of the OrthoRead graphic user interface that will be released.

2. *Describe the current state of the technology and related product/service:* The technology is currently being validated by analyzing radiographs of clinical fractures and comparing these automated values to manual measurements by trained orthopaedic surgeons. Once validated, the software will be distributed to a select group of surgeons for Beta testing.

3. *List the number of faculty and student participants as a result of funding:* **Three students and one faculty member** were funded from this project. The students were Evan Rust (undergraduate in Mechanical Engineering), Christina Sundgren (graduate in Mechanical Engineering), and Stephen Porter (undergraduate in Computer Science). The faculty member was Dr. Trevor Lujan in Mechanical and Biomedical Engineering.

4. *What are the potential economic benefits:* OrthoRead will be the first software to automate the identification of radiographic features related to fracture healing. This technology has utility in all orthopaedic clinics and orthopaedic research centers. By quickly quantifying healing parameters, this technology can help identify treatment strategies that are most effective, and thus help reduce medical costs from delayed fracture healing and non-unions.

5. *Description of future plans for project continuation or expansion:* Since the completion of the grant period on June 30th, Dr. Lujan has continued to fund this project from his start-up account in order to finalize the technology for Beta launch. In the next month, Dr. Lujan is meeting with an industry ventures director at Boise State University to discuss intellectual property, and an abstract on this technology is being submitted to the annual meeting of the Orthopaedic Research Society. Next, software validation will be finalized and a full manuscript will be submitted for publication. A Beta version will be made available to surgeon colleagues prior to commercial launch.

6. *Please provide a final expenditure report (attached) and include any comments here:* The discovery of free software eliminated costs that were originally budgeted for software purchases. Furthermore, the amount budgeted for industry consultation was not spent, as the software is still under validation testing. The budget for these items was transferred to cover salaries of staff working on the project.

7. *List invention disclosures, patent, copyright and PVP applications filed, technology licenses/options signed, start-up businesses created, and industry involvement:* Dr. Lujan has a pending meeting with Industry Ventures at Boise State University.

8. Any other pertinent information:

FINAL EXPENDITURE REPORT

A. FACULTY AND STAFF		
Name/Title	\$ Amount Requested	Actual \$ Spent
Dr. Trevor Lujan / Assistant Professor	8387.00	8389.33
B. VISITING PROFESSORS		
Name/Title	\$ Amount Requested	Actual \$ Spent
C. POST DOCTORAL ASSOCIATES/OTHER PROFESSIONALS		
Name/Title	\$ Amount Requested	Actual \$ Spent
D. GRADUATE/UNDERGRADUATE STUDENTS		
Name/Title	\$ Amount Requested	Actual \$ Spent
Stephen Porter / Undergraduate Student	6500.00	3442.25
Evan Rust / Undergraduate Student	6500.00	4369.00
Christina Sundgren / Graduate Student		8307.72
E. FRINGE BENEFITS		
Rate of Fringe (%)	\$ Amount Requested	Actual \$ Spent
Dr. Trevor Lujan (25%), Steven Porter (4%), Christina Sundren (3%), Evan Rust (0.4%)	3546.00	2491.70
PERSONNEL SUBTOTAL:		
F. EQUIPMENT: (List each item with a cost in excess of \$1000)		
Item/Description	\$ Amount Requested	Actual \$ Spent
1. Software and Materials	1,068.00	0.00
2.		
3.		
4.		
EQUIPMENT SUBTOTAL:		
G. TRAVEL		
Description	\$ Amount Requested	Actual \$ Spent
1.		
2.		
3		
TRAVEL SUBTOTAL:		

H. PARTICIPANT SUPPORT COSTS:		
Description	\$ Amount Requested	Actual \$ Spent
1. Consultant fees	1,000.00	0.00
2.		
3		
PARTICIPANT SUPPORT COSTS SUBTOTAL:		
I. OTHER DIRECT COSTS:		
Description	\$ Amount Requested	Actual \$ Spent
1.		
2.		
3.		
OTHER DIRECT COSTS SUBTOTAL:		
TOTAL COSTS (Add Subtotals):		
	27,000	27,000
TOTAL AMOUNT REQUESTED:		27,000.00
TOTAL AMOUNT SPENT:		27,000.00